

ADDENDUM No. 1		LSU	BID DUE DATE AND TIME	
BOARD OF SUPERVISORS OF LOUISIANA STATE UNIVERSITY AND AGRICULTURAL & MECHANICAL COLLEGE			10/14/2005 11:00 am CT	
SOLICITATION B6CSN0056 VENDOR # VENDOR NAME AND ADDRESS <div style="border: 1px solid black; height: 80px; width: 100%;"></div>			RETURN ADDENDUM TO FAX 225-578-2292 Louisiana State University Purchasing Office 213 Thomas Boyd Hall Baton Rouge, LA 70803 BUYER CHARLOTTE NEWMAN BUYER PHONE 225-578-2290 ISSUE DATE 10/06/2005 # of Pages: 25	
TITLE: MODULAR CLASSROOM				

Notice is given to all parties that this Solicitation is amended by the University as stated herein. This Addendum is hereby made an official part of this Solicitation.

SUBSTITUTE THE ATTACHED SPECIFICATIONS FOR THE ONES ORIGINALLY INCLUDED.

DRAWINGS REMAIN UNCHANGED.

This Addendum is to be signed and returned with your bid or otherwise acknowledged therein. If you have already submitted your bid, and this Addendum creates a need to revise/clarify your original response in any way, you are required to submit such in writing. To be considered, your addendum response must be submitted to and received by the issuing LSU Campus/Department at the "Return Bid To" address stated above no later than the specified bid due date/time. Submittals must be clearly marked with the solicitation number and the bid due date/time and returned via fax, courier service, hand delivery, or USPS mail. Bid revisions received after bid opening cannot be considered, whereupon the bidder must either honor or withdraw its original bid.

Bidder's Addendum Acknowledgement/Response:

As an authorized agent/signatory of the bidder, I/we acknowledge receipt of this Addendum, and
 _____ submit no alterations/clarifications to our original bid.
 _____ submit superseding revisions/clarifications to our original bid as written herein or attached hereto.

BIDDER (Name of Firm)	MAILING ADDRESS
AUTHORIZED SIGNATURE	CITY, STATE ZIP
PRINTED NAME	PHONE #
TITLE	FAX #
E-MAIL	FEDERAL TAX ID #

LSU IS AN EQUAL OPPORTUNITY/ACCESS UNIVERSITY

SPECIFICATIONS

Firing Range Modular Classroom

For

LSU Police Department

Louisiana State University

SCOPE OF FIRING RANGE MODULAR CLASSROOM BUILDING

The scope includes purchase of a Modular Building as indicated on the enclosed drawings and in conformance with these specifications and applicable codes and regulations. Included is one (1) building, approximately 24 ft. x 64 ft., that is to be located at the site indicated on the attached Vicinity Map.

OWNER RESPONSIBILITIES

The Owner will be responsible for the following:

1. Utility connection; Electrical service and connection to the building shall be provided by the Police Department.
2. Internet and telephone service and connection to each building shall be provided by the Police Department.
3. Sealed drawings shall be prepared and submitted to the Fire Marshal by the Office of Facility Development on behalf of the Police Department.

SCHEDULE AND DELIVERY

Delivery and installation of the building is to be completed within a maximum of forty five (45) days after a contract is awarded.

The bidder shall verify existing conditions including turning radius of hauler and provide any necessary equipment if needed to position the modular building at the proposed location.

COORDINATION

Work shall be coordinated thru the LSU Office of Facility Development.

Drawings shall be prepared and submitted to the State Fire Marshal's Office for review by the Office of Facility Development. Drawings shall be based on successful bidders standard modular building meeting applicable code requirements.

Utility connections, (electrical, water, plumbing) to the building shall be provided by LSU.

CODE COMPLIANCE

In general provide a modular building that conforms to applicable requirements of codes required by State and Local Authorities for the building to be used for the use indicated.

The structural system is to be capable of supporting a 50 PSF floor load, and 25 PSF positive or negative roof live load according to the Southern Building Code Congress and International Building Code.

Provide structural tie downs in accordance with applicable codes.

All local, state, and federal codes are to take precedence over these specifications. It is the bidder's responsibility to ensure code compliance.

All storage room walls are to have a 1 hour fire rating and extend up to the roof deck. Corridor walls are to have a 1 hour minimum fire rating in accordance with code requirements. Doors and door assemblies are to have fire ratings where required by code authorities.

Provide corridors with a minimum of 44 inches in clear width.

Buildings shall at a minimum meet requirements of Type VI Construction, Use Group B, 1991 SPC, 1991 SMC, 1996 NEC.

Buildings are to comply with requirements of the Louisiana State Fire Marshall.

FIRE EXTINGUISHERS

Provide wall mounted 5 lb. ABC fire extinguishers at each location on the plans marked F.E. Two extinguishers minimum required.

PERMITS AND FEES

Necessary permits and fees for transportation/licenses are to be the responsibility of the bidder and costs, if any, are to be included in vendor's bid price.

BUILDING SPECIFICATIONS:

Final building design plans must be sealed by an Engineer/Architect registered in the State

of Louisiana.

DIMENSIONS AND LAYOUT

Refer to attached drawings for general size and layout. Actual dimensions may vary to allow standard products of various modular building manufacturers to be considered.

The building interior space is to have minimum dimensions indicated on the drawings. Toilet room and shower are to comply with requirements of handicap accessibility set forth by ADA and Life Safety Codes.

Porch, deck, ramp, steps, rails and guard rails shown indicate minimum standards and requirements and are to be constructed of pressure treated pine. Construction of these items shall be on site.

Provide 4 inch concrete landings and walkway as indicated.

FRAME

Outrigger and crossmember at 48" o.c., beam size is to be 12" JR-1. Axles are to be triple 6000# rated with brakes on 2. Hitch is a detachable underslung.

FLOOR STRUCTURAL SYSTEM

Provide design for minimum 50 lb live load.

FLOOR MATERIAL

Floor tile shall be 1/8" gauge 12x12 vinyl tiles. All material shall have a flame spread rating of less than 75 when tested in accordance with ASTM E-84 tunnel test. Toilet room, shower, and corridor are to be vinyl floor tile.

Both classrooms and the closet are to have carpet tile.

Carpet is to be Interface Carpet Tile, Silk Route Modular GlasBac Tile. Color is to be selected by Architect from the manufacturer's standard selection.

INSULATION

Provide the following minimum types of insulation:

- | | | |
|----|----------------|-----------------------------------|
| 1. | Floors: | R-11 Unfaced fiberglass batts |
| 2. | Exterior Walls | R-11 Kraft faced fiberglass batts |
| 3. | Roof | R-19 Kraft faced fiberglass batts |

EXTERIOR WALLS

Provide design for 110 MPH wind load.

FRAMING

All exterior wall framing members are to be 2x4 #2 southern pine, spruce or fir @ 16" O.C. with double studs at all exterior and window openings, triple studs at all exterior corners, and double top plates. All headers are to be sized to meet or exceed the applicable roof and wind loads called for in local code. Wind bracing is to be 1x4, mortised into framing diagonally.

EXTERIOR SIDING

Siding is to be .019 Aluminum. Color of exterior wall siding to be manufacturer's standard neutral color, white, beige or gray.

EXTERIOR TRIM

Manufacturer's standard trim material for soffits, eaves, and doors. Colors in base bid are to be manufacturer's standard trim color.

DOOR HARDWARE AND ACCESSORIES

Manufacturer's standard meeting required codes including ADA requirements.

DOOR CLOSERS

Automatic door closers to be surface-mounted and have a closing and latching speed adjustment controlled by means of a single regulating valve fully adjustable after installation. Closer is to have a rack and pinion mechanism contained in a high tensile aluminum precision housing. Hydraulic fluid is to be stable for any climatic operation and constant lubrication.

PANIC HARDWARE

Von Duprin Series 22NL or equal exit devices required for all exterior doors. Install per manufacturer's recommendations.

ROOFING AND CEILING SYSTEMS

ROOF FRAMING

All roof framing members are to be of heavy timber construction. Roof beams are to transfer loads directly onto load-bearing walls, partitions, and trusses. Beams shall be southern pine, spruce, or fir, sized and spaced to meet requirements for all dead loads plus a minimum live load of 20 lbs. per sq. Foot.

ROOFING

The roof is to be 45 mil black single ply membrane over sheathing or decking. Comply with requirements of codes for live and wind loads.

Provide venting per codes.

CEILING

Ceiling material is to be a Class A prefinished 2ft x 2ft suspended acoustical ceiling tiles and grid. Toilet room and shower ceiling material is to be moisture resistant and scrubable meeting or exceeding requirements of applicable codes having jurisdiction.

WINDOWS

Aluminum frame in manufacturer's standard sizes. Provide 1" mini blinds for each window, typical.

MATERIAL SUBSTITUTION

In some instances, circumstances may dictate substitutions. All changes and/or substitutions of materials, products, equipment, etc., as specified herein may be made by the contractor, provided that such change and/or substitution be of like grade and equal or better quality than the originally specified items. All such changes are to be made in writing to the owner and prior approval in writing by the owner.

DAMAGE TO EXISTING PROPERTY

Contractor is responsible for taking photographs of existing site conditions and making repairs to the owner's property that results from damage he causes.

FOUNDATIONS, ANCHORING AND SITE WORK

FOUNDATION

Footings and necessary blocking required to level building is to be installed by contractor. Footing locations and anchoring are to be adequate to meet the requirements of the applicable and appropriate building codes. The contractor is to be responsible for re-leveling the building if required during a one year warranty period. Set finished floor level at 42 inches above existing grade as indicated on drawings.

SKIRTING

Foundation skirting is to be provided and installed to grade. Skirting will be fabricated from material to match the siding of the building. Contractor to install after utility connections are completed by the university.

PORCH/DECK/RAMP/STEPS/RAILS/GUARD RAILS

Porch, decks, ramps, steps, rails and guard rails shall be pressure treated pine. Design and build in accordance with applicable codes and regulations including ADA. Ramp and stairs on drawing shows the floor elevation set at 42 inches above the existing grade.

and making repairs to the Owner's property that results from damage he causes.

WARRANTY

Contractor to provide a one-year labor, material, and installation warranty from the date of substantial completion.

ELECTRICAL

The building shall be completely factory wired for power. All circuits shall be factory wired back to main electrical service panel "A" located as shown on the drawings. This panel shall be UL service entrance rated, flush mounted, with ratings and main and branch circuit breakers as scheduled on the drawings. A concealed 2" empty SCH 40 PVC conduit shall be stubbed out of the bottom of the panel through the floor for the service conductors (service conductors to be supplied by others). A 3/4" empty PVC conduit shall be stubbed out through the floor from the main panel for the service ground (service ground conductor to be provided by others). The main panel shall have a door, an equipment ground bar, full size neutral bar and molded case thermal magnetic branch circuit breakers. The panel shall be by Square D, Siemens, Cutler Hammer, GE or approved equal. Provide a directory listing items/location served by each branch circuit breaker.

All wiring shall be in accordance with the National Electric Code, and all other applicable state and local codes. All wiring shall utilize copper conductors with type THW, THWN or THHN insulation in galvanized EMT conduit or shall utilize type MC cable with a full size equipment grounding conductor. All conduit or cable shall be attached to the building structure at appropriate intervals and shall not rest on the ceiling grids. The minimum wire size shall be #12. Wiring shall be #10 minimum for 30 amp circuits. #12 and #10 wire shall be solid (not stranded). Lighting/exhaust fans shall be wired on different circuits from receptacles. Branch circuits shall be fed from 20A circuit breakers and shall be wired with a maximum of 1600VA on each lighting/exhaust fan circuit. There shall be a maximum of five(5) general use receptacles on a single general use receptacle circuit. A separate 20A dedicated circuit shall be provided for each receptacle noted on the drawings with a "DC" (dedicated circuit).

Wiring in conduit shall be increased in size when required by derating due to more than three current carrying conductors in a raceway per nec 310-15(b)(2)(a). For the purpose of this derating, all phase and neutral conductors shall be considered current carrying. Provide a separate equipment grounding conductor with green colored insulation sized per the NEC in each conduit or cable run.

Receptacles shall be duplex type, 20A, spec grade, grounding, Leviton no. 5362 series or equal. Receptacles noted with GF or required by code to have ground fault protection shall be Leviton 6599 series or equal. Receptacles noted as WP shall have a weatherproof cover. Switches shall be 20A, spec grade, silent operating, Leviton 1221 series or equal. Switches for 3 way or 4 way operation shall be Leviton 1223 or 1224 series or equal.

Lighting fixtures shall be as specified on the drawings or approved equal. For fixtures that are recessed ceiling mounted, provide for NEC required thermal safety cutout devices attached to the lamp housing.

Fluorescent lamps shall have 4100k correlated color temperature with a CRI of 75 minimum. Fluorescent lamps shall be by General Electric, Sylvania/Osram or Phillips. T8 fluorescent lamps shall be General Electric SP41 series, Phillips TL 70 series or Osram/Sylvania Octron 700 series, with a 20,000 hour minimum lifetime, 2800 minimum initial lumens and 32 nominal lamp watts for a four foot length lamp.

The contractor shall support each fixture directly from building structural members independent of any ceilings or other installed item. Provide supplemental angle or channel trapeze supports required to span across piping, ductwork or other objects where direct above the fixture support is not possible. Do not attach to the ductwork. All support and weight of the fixture must be borne by the structure.

For recessed fixtures provide a minimum of 4 feet, but not more than 6 feet, of steel constructed flexible metal conduit between the last branch wiring junction box and the junction box at the fixture to allow the fixture to be relocated to an adjacent ceiling tile without wiring modifications. This section of flexible conduit shall contain a green colored equipment grounding conductor. Do not loop from fixture to fixture with flexible conduit or MC cable.

TELEPHONE/DATA

For each data/telephone outlet, provide a 1" conduit from a recessed 2 gang, 2-1/8" deep wall box to the ceiling space above. Wall box is to have a single gang plaster ring. Only the box, conduit, and pull wire shall be provided by the contractor. The jack, coverplate and wiring of the data/telephone system shall be by others. Data/telephone conduits shall have long radius sweeping turns and shall terminate with bushings on the end.

Provide a 3' long by 8' tall communications backboard for the telephone /data service. The backboard shall be 3/4" plywood painted with fire retardant paint. Provide one 3" empty conduit with pull string from the tel/data service backboard through the floor for telephone and data service. The telephone and data service conductors will be provided by others.

SECTION 15260

PIPING INSULATION

PART I GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.02 REFERENCES

- A. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- B. ASTM C195 - Mineral Fiber Thermal Insulation Cement.
- C. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
- D. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.
- E. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- F. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- G. ASTM C547 - Mineral Fiber Preformed Pipe Insulation.
- H. ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
- I. ASTM C591 - Rigid Preformed Cellular Urethane Thermal Insulation.
- J. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
- K. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- L. ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

- M. ASTM E84 - Surface Burning Characteristics of Building Materials.
- N. ASTM E96 - Water Vapor Transmission of Materials.
- O. NFPA 255 - Surface Burning Characteristics of Building Materials.
- P. UL 723 - Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

- A. Product Data: Provide product description, list of materials and thickness for each service, and locations.
- B. Samples: Submit two samples of any representative size illustrating each insulation type.
- C. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

- A. Materials: Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84.

1.05 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum three years experience.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART II PRODUCTS

2.01 GLASS FIBER

- A. Insulation: ASTM C547; rigid molded, noncombustible.
 - 1. 'K' ('ksi') value : ASTM C335, 0.24 at 75 degrees F.
 - 2. Minimum Service Temperature: -20 degrees F.
 - 3. Maximum Service Temperature: 300 degrees F.
 - 4. Maximum Moisture Absorption: 0.2 percent by volume.
- B. Vapor Barrier Jacket
 - 1. ASTM C921, White kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
 - 3. Secure with self sealing longitudinal laps and butt strips.
 - 4. Secure with outward clinch expanding staples and vapor barrier mastic.
- C. Tie Wire: 18 gage stainless steel with twisted ends on maximum 12 inch (300 mm) centers.
- D. Vapor Barrier Lap Adhesive
 - 1. Compatible with insulation.
- E. Insulating Cement/Mastic
 - 1. ASTM C195; hydraulic setting on mineral wool.
- F. Fibrous Glass Fabric
 - 1. Cloth: Untreated; 9 oz/sq yd weight.
 - 2. Blanket: 1.0 lb/cu ft density.
- G. Indoor Vapor Barrier Finish
 - 1. Vinyl emulsion type acrylic, compatible with insulation, white color.
- H. Outdoor Vapor Barrier Mastic
 - 1. Vinyl emulsion type acrylic, compatible with insulation, white color.
- I. Insulating Cement
 - 1. ASTM C449.

2.02 JACKETS

A. PVC Plastic

1. Jacket: ASTM C921, One piece molded type fitting covers and sheet material, off white color.
 - a. Minimum Service Temperature: -40 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Transmission: ASTM E96; 0.002 perm inches.
 - d. Maximum Flame Spread: ASTM E84; 25.
 - e. Maximum Smoke Developed: ASTM E84; 50.
 - f. Thickness: 15 mil.
 - g. Connections: Pressure sensitive color matching vinyl tape
2. Covering Adhesive Mastic
 - a. Compatible with insulation.

B. ABS Plastic

1. Jacket: One piece molded type fitting covers and sheet material, off white color.
 - a. Minimum Service Temperature: -40 degrees F.
 - b. Maximum Service Temperature of 180 degrees F.
 - c. Moisture Vapor Transmission: ASTM E96; 0.012 perm inches.
 - d. Thickness: 30 mil.
 - e. Connections: Brush on welding adhesive.

PART III EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. On exposed piping, locate insulation and cover seams in least visible locations.
- C. Insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:
 1. Provide vapor barrier jackets, factory applied or field applied.
 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.

3. Finish with glass cloth and vapor barrier adhesive.
 4. PVC fitting covers may be used.
 5. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
 6. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, [pump bodies,] and expansion joints.
- D. For insulated pipes conveying fluids above ambient temperature:
1. Provide standard jackets, with or without vapor barrier, factory applied or field applied.
 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
 3. Finish with glass cloth and adhesive.
 4. PVC fitting covers may be used.
 5. For hot piping conveying fluids 140 degrees or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- E. Inserts and Shields:
1. Application: Piping 2 inches diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Insert Location: Between support shield and piping and under the finish jacket.
 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 5. Insert Material: ASTM C640 cork, hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- F. Finish insulation at supports, protrusions, and interruptions.
- G. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum or stainless steel jacket with seams located on bottom side of horizontal piping.
- H. For buried piping, provide factory fabricated assembly with inner all-purpose service jacket with self sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.
- I. For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum or stainless steel jacket with seams located on bottom side of horizontal piping.

3.03 TOLERANCE

- A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.04 GLASS FIBER INSULATION SCHEDULE

A.	PIPING SYSTEMS	PIPE SIZE	THICKNESS
		Inch	Inch
A.	Plumbing Systems:		
	Domestic Hot Water Supply	All	1/2"
	Domestic Cold Water	All	1/2"

END OF SECTION

SECTION 15290

DUCTWORK INSULATION

PART I GENERAL

1.01 SECTION INCLUDES

- A. Ductwork insulation.
- B. Insulation jackets.

1.02 REFERENCES

- A. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- B. ASTM C553 - Mineral Fiber Blanket and Felt Insulation.
- C. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.
- D. ASTM E84 - Surface Burning Characteristics of Building Materials.
- E. ASTM E96 - Water Vapor Transmission of Materials.
- F. NFPA 255 - Surface Burning Characteristics of Building Materials.
- G. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- H. UL 723 - Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

- A. Product Data: Provide product description, list of materials and thickness for each service, and locations.
- B. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

- A. Materials: Flame spread/smoke developed rating of 25/50 in accordance with NFPA 255].

1.05 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum three years experience.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART II PRODUCTS

2.01 GLASS FIBER, FLEXIBLE

- A. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. 'K' ('Ksi') value : ASTM C518, 0.31 at 75 degrees F.
 - 2. Maximum service temperature: 250 degrees F.
 - 3. Maximum moisture absorption: 0.20 percent by volume.
 - 4. Density: 1.0 lb/cu ft.
- B. Vapor Barrier Jacket
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film
 - 2. Moisture vapor transmission: ASTM E96; 0.04 perm.
 - 3. Secure with pressure sensitive tape.
- C. Vapor Barrier Tape
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- D. Tie Wire: Annealed steel, 16 gage.

2.02 GLASS FIBER, RIGID

- A. Insulation: ASTM C612; rigid, noncombustible blanket.
 - 1. 'K' ('Ksi') value : ASTM C518, 0.29 at 75 degrees F.
 - 2. Maximum service temperature: 250 degrees F.
 - 3. Maximum moisture absorption: 0.20 percent by volume.
 - 4. Density: 1.5 lb/cu ft.
- B. Vapor Barrier Jacket

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film
 2. Moisture vapor transmission: ASTM E96; 0.04 perm.
 3. Secure with pressure sensitive tape.
- C. Vapor Barrier Tape
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive

PART III EXECUTION

3.01 EXAMINATION

- A. Verify that ductwork has been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
 1. Provide insulation with vapor barrier jackets.
 2. Finish with tape and vapor barrier jacket.
 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- B. External Duct Insulation Application:
 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 2. Secure insulation without vapor barrier with staples, tape, or wires.
 3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers. Ducts with flat dimensions greater than 24 inches shall use pins to secure insulation to ductwork.
 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3.03 TOLERANCE

- A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.04 FLEXIBLE GLASS FIBER DUCTWORK INSULATION SCHEDULE

DUCTWORK	THICKNESS FINISH
	Inch (mm)
Exhaust Ducts	3/4"
Outside Air Intake Ducts	1 1/2"
Supply Ducts	2"

END OF SECTION

SECTION 15890

DUCTWORK

PART I GENERAL

1.01 SECTION INCLUDES

- A. Metal ductwork.
- B. Duct cleaning.

1.02 REFERENCES

- A. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- B. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- C. ASTM A 366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality.
- D. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- E. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- F. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.
- G. ASTM A 568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
- H. ASTM A 569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
- I. AWS D9.1 - Welding of Sheet Metal.
- J. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- K. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.
- L. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden

- M. SMACNA - HVAC Air Duct Leakage Test Manual.
- N. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- O. UL 181 - Factory-Made Air Ducts and Connectors.

1.03 PERFORMANCE REQUIREMENTS

- A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work.
- B. Product Data: Provide data for duct materials and duct connectors
- C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.
- D. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.

1.05 PROJECT RECORD DOCUMENTS

- A. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- B. Maintain one copy of document on site.

1.07 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing the work of this section with minimum three years experience.

1.08 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A and NFPA 90B standards.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealants.

PART II PRODUCTS

2.01 MATERIALS

- A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90.
- B. Steel Ducts: ASTM A366.
- C. Insulated Flexible Ducts:
 - 1. Two ply vinyl film supported by helically wound spring steel wire; fiberglass insulation; aluminized vapor barrier film.
 - 2. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
 - 3. Maximum Velocity: 4000 fpm.
 - 4. Temperature Range: -10 degrees F to 160 degrees F.

2.02 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Construct T's, bends, and elbows with radius of not less than 1½ times width of duct on centerline. Where not possible and where rectangular elbows are used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.
- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

- D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
- E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

2.03 MANUFACTURED DUCTWORK AND FITTINGS

- A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Double Wall Insulated Round Ducts:
 - 1. Round spiral lockseam duct with galvanized steel outer wall, 1 inch thick fiberglass insulation, galvanized steel inner wall; fitting with solid inner wall.

PART III EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- C. Duct Sizes are inside clear dimensions.
- D. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- F. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

- G. Use double nuts and lock washers on threaded rod supports.
- H. Connect flexible ducts to metal ducts with liquid adhesive plus tape.

3.02 CLEANING

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.
- B. Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

3.03 SCHEDULES

A. DUCTWORK MATERIAL SCHEDULE

AIR SYSTEM	MATERIAL
Low Pressure Supply (System with Cooling Coils)	Glass
Return and Relief	Steel
General Exhaust	Steel
Outside Air Intake	Steel

B. DUCTWORK PRESSURE CLASS SCHEDULE

AIR SYSTEM	PRESSURE CLASS
Supply (System with Cooling Coils)	2 inch
Return and Relief	1 inch
General Exhaust	1 inch
Outside Air Intake	½ inch

END OF SECTION